Journal of Forensic and Legal Medicine 21 (2014) 56–58

Contents lists available at ScienceDirect

Journal of Forensic and Legal Medicine

journal homepage: www.elsevier.com/locate/jflm

Case review

Potential dangers of hay bailing

Cheryl Charlwood, MB, Chb Forensic Pathologist [a],
Roger W. Byard, MD Forensic Pathologist, Prof [a,b,*]

[a] Forensic Science SA, 21 Divett Place, Adelaide 5000, Australia
[b] Discipline of Anatomy & Pathology, The University of Adelaide, Frome Rd, Adelaide 5005, Australia

ARTICLE INFO

Article history:
Received 16 October 2013
Accepted 2 November 2013
Available online 10 November 2013

Keywords:
Hay baling
Farming
Machinery
Agriculture
Death
Injury

ABSTRACT

Individuals engaged in farming have higher risks of injury and death from trauma than many other workers. Fatalities most often involve tractor-related incident such as roll-overs. Although it is also recognized that farm machinery may result in serious injuries and death, little has been reported on problems associated with hay baling, transport and storage. Case 1: A 43-year-old man trying to dislodge jammed hay in a hay baler had either been pulled, or had fallen, into the baler, where he had been crushed, rotated and then cocooned within a hay bale. The body showed extensive blunt trauma to the head, neck, chest, abdomen, pelvis and limbs, with burning from a fire that subsequently started within the overheated machine. Case 2: A 58-year-old man was crushed between the moving arms of a hay shuttle and a safety fence. Death was attributed to blunt chest and abdominal trauma with crush asphyxia. Case 3: A 56-year-old man fell some distance from the top of stacked hay bales fracturing his neck and causing virtual transection of his cervical spinal cord. These cases demonstrate rare forms of farm deaths that may be associated with the creation (baling), moving (shuttling) and storage of hay bales. All forms of farm machinery should be treated circumspectly, given the possibility that serious injury or death may result from inattention or inappropriate handling. Temporary stacking of hay bales may create high work platforms that risk falls with lethal consequences.

1. Introduction

Farming and agricultural work in general have been associated with high levels of work place injury and death in a number of countries.[1,2] While many of the fatalities are due to vehicle related incidents such as tractor roll-overs,[3] lethal events may be caused by the wide range of other equipment and situations. We report three deaths associated with hay baling, moving and storage to demonstrate specific features of such cases.

2. Case reports

Case 1: The body of a 43-year-old man was found compressed inside a bale of hay within a burning hay baling machine (Fig. 1). The machine was still switched on with the baler slowly rotating. The decedent had last been witnessed to be driving on his own to the machine to start hay baling. At autopsy the body was removed from the bale of hay which had been enclosed in nylon sheeting. The most significant findings included blunt trauma to the head (with complex skull and facial skeletal fractures, and disruption of the brain), blunt neck and chest trauma (with fractures of the larynx, ribs and sternum, and lacerations of the lungs), blunt abdominal and pelvic trauma (with lacerations of the liver and fractures of the pelvis and sacroiliac joints) and blunt leg trauma (with compound fractures). There were also large areas of skin charring, post mortem abrasions and patchy bruises and lacerations. Toxicology showed that no alcohol or common drugs were present. Death was attributed to multiple injuries. Integrating the autopsy findings with the circumstances at the death scene and the results of the examination of the hay baler indicated that the decedent had most likely attempted to dislodge hay that had jammed in the front feeder section of the machine while it was still operating. He had either been pulled, or had fallen, into the baler, where he had been crushed, rotated and cocooned within a hay bale.

Case 2: A 58-year-old man was found by his work mates to be wedged between the moving arms of a hay shuttle and a safety fence (Fig. 2). He was trapped for approximately five to 10 min. Resuscitation was attempted at the scene and at the local hospital without success. At autopsy there was evidence of compression of

* Corresponding author. Discipline of Pathology, Level 3, Medical School North Building, The University of Adelaide, Frome Road, Adelaide 5005, Australia. Tel.: +61 8 8303 5441; fax: +61 8 8303 4408.
E-mail address: roger.byard@sa.gov.au (R.W. Byard).

1752-928X/$ – see front matter
http://dx.doi.org/10.1016/j.jflm.2013.11.003

Fig. 1. The arm of a 43-year-old man protruding from a hay bale. He suffered extensive crush injuries after he had fallen into a mechanical bailer.

the chest and abdomen with facial petechiae, multiple rib fractures, lacerations and contusions of the lungs, and lacerations of the spleen and liver with haemothoraces, haematoperitoneum and retroperitoneal haemorrhage. Linear marks across the left side of the abdomen (Fig. 3) corresponded to the edges of the movable arm of the shuttle. An addition finding was of underlying ischemic heart disease with myocardial scarring, cardiomegaly and previous coronary artery bypass grafting. Toxicology showed that no alcohol was present, with ketamine associated with medical treatment being the only common drug detected. Death was attributed to blunt chest and abdominal trauma with crush asphyxia. It is unclear why the decedent had become caught between the machine and the safety barrier. Neither machine in case 1 or case 2 was found to be defective.

Case 3: A 56-year-old man fell some distance from the top of stacked hay bales on a farm injuring his neck. He had no previous significant medical history. On admission to hospital he was found to be quadraplegic with a blood pressure of 80/50 and paradoxical abdominal respiration. Radiological examination revealed a fracture of the posterior arch of the second cervical vertebra with slight separation, fracture of the base of the spinous process of the fifth cervical vertebra, and fracture-dislocation of the sixth on the seventh cervical vertebrae. His clinical condition deteriorated and he died six days later. At autopsy the major findings were limited to the neck where the above fractures were confirmed. In addition the spinal cord showed virtual transaction at the C5-6 level with marked softening (Fig. 4). Other findings included anterior subgaleal hematoma formation with cerebral oedema. There were no skull fractures.

3. Discussion

The agricultural industry has had a long history of worker injury and death. Arduous physical activities performed for long hours during the day and night increase risks. The need to harvest crops at specific times of the year may mean that increased amounts of work are being undertaken under suboptimal weather conditions by individuals who may not have adequate training in equipment use. Those injured may include family members or children. Worker fatigue and economic pressures may be significant factors at these times.[4]

Machinery that is used on farms may be quite varied in terms of function, age and degree of maintenance. Safety barriers may either not be installed or may have been removed to facilitate access to engines; although as cases 1 and 2 demonstrate, fatalities may still occur with well maintained equipment. One of the most common causes of farm deaths has been tractor rollovers, resulting in either blunt force injury, or crush asphyxia, or both.[1] Efforts to install roll bars on tractors have, however, reduced the numbers of these deaths. Another type of injury associated with tractors occurs if a worker is caught in the rotating power takeoff at the back of a tractor. Serious injuries and death may follow with soft tissue degloving, fractures and amputations.[5,6]

Additional problems may arise from animal related trauma with crushing and goring.[7] In Australia, 7.1% of deaths in those aged over 55 years in the agricultural industry have been due to animals, with horses causing most deaths, followed by cattle.[8] An age and gender related vulnerability has also been demonstrated in the United States where those most at risk are males over the age of 65 years.[9] Significant blunt trauma can, however, be inflicted by a variety of smaller animals including sheep and calves.[10–12]

Fig. 2. A hay shuttle that moved along a gantry in the direction of the arrow trapping a 58-year-old man between the back of the cage and the wire mesh of the safety fence.

Fig. 3. Linear parchmenting on the abdomen of the man trapped between the shuttle shown in Fig. 2 and the safety fence. The marks corresponded to protrusions on the shuttle.

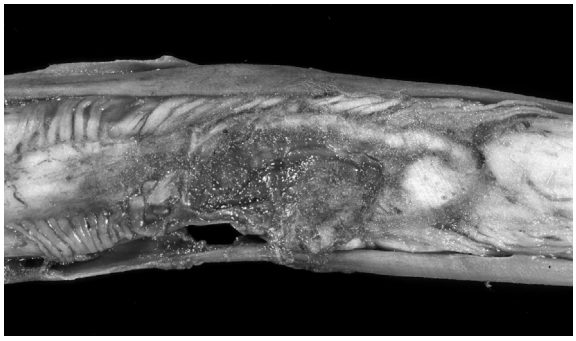

Fig. 4. Longitudinal section of the cervical spinal cord demonstrating disruption and haemorrhage following a fall from a height.

Other types of farm injuries or deaths involve immersion, asphxyiation in silos or under grain, or falls.[4] The latter may occur from the top of stored hay bales as in case 3, as stacks may be quite high and unstable. A major difference in farming situations compared to other occupations where workers may be operating at some distance above the ground, is the absence of guard rails and safety harnesses. Farmers and their employees may also be working alone a considerable distance from assistance should the need arise. In Australia, for example farms may cover many hundreds of kilometers and have areas that are well outside the reach of mobile phone coverage.

One of the pieces of equipment involved in the processing of hay is the baler, a mechanical device designed to compress and package hay to enable storage and transport. Although injuries have not been well documented in the literature, balers may cause upper limb injury with tissue loss, devascularization or amputation.[13] In a series of 12 survivors of hay baler injuries, the majority (11 out of 12) had been drawn into the machines by their arms, with 50% of them requiring amputation due to the extensive tissue destruction. Of note, in three cases the victims were attempting to deal with a malfunction, as in case 1, and in one case the baler also caught fire burning the entrapped victim.[14] Other machines may be used in the handling of hay bales, such as a hay shuttle in case 2 that is used to facilitate the movement of bales. In the second case the victim was crushed between the moving arm of the machine and a safety barrier.

The reported cases demonstrate rare forms of farm deaths involving machinery used to create (bale) and move (shuttle) hay bales, and also from storage of bales. As with all industrial accidents a full work site investigation is required to determine how safe the location was and whether an error involving equipment was with the operator or the machine, and whether the machine complied with safety regulations. As is often the case with industrial accidents, injuries occur when an attempt is made to correct a malfunction without either turning a machine off, or effectively disabling it. The autopsy examination should aim to determine the cause and mechanism of death, and correlate the injuries present with the described event. Patterned injuries may be particularly useful in matching a specific area of the body with a specific part of the machine. Hay balers in particular may be associated with extensive crushing injuries and possible superimposed burning, as in case 1. As these cases demonstrate, all forms of farm machinery, including those that are well maintained, should be treated circumspectly given the possibility that serious injury or death may result from inattention or inappropriate handling. Working from heights without safety harnesses may incur a risk of falling.

Conflict of interest

None.

Ethical approval

Forensic Science SA.

Funding

None.

References

1. Myers JR, Layne LA, Marsh SM. Injuries and fatalities to U.S. farmers and farm workers 55 years and older. *Am J Ind Med* 2009;**52**:185–94.
2. Rissanen P, Taattola K. Fatal injuries in Finnish agriculture, 1988–2000. *J Agric Saf Health* 2003;**9**:319–26.
3. Rautiainen RH, Reynolds SJ. Mortality and morbidity in agriculture in the United States. *J Agric Saf Health* 2002;**8**:259–76.
4. Byard RW. Accidental childhood death and the role of the pathologist. *Pediatr Develop Pathol* 2000;**3**:405–18.
5. Byard RW, Gilbert J, James R, Lipsett J. Pathological features of farm and tractor – related fatalities in children. *Am J Forensic Med Pathol* 1999;**20**:73–7.
6. Dogan KH, Demirci S, Sunam GS, Deniz I, Gunaydin G. Evaluation of farm tractor-related fatalities. *Am J Forensic Med Pathol* 2010;**31**:64–8.
7. Bury D, Langlois NEI, Byard RW. Animal-related fatalities sI: characteristic autopsy findings and variable causes of death associated with blunt and sharp trauma. *J Forensic Sci* 2012;**57**:370–4.
8. *Traumatic deaths in Australian agriculture – the facts*. Rural Industries Research and Development Corporation and Australian Centre for Agricultural Health and Safety; 2007.
9. Langley RL, Hunter JL. Occupational fatalities due to animal-related events. *Wilderness Environ Med* 2001;**12**:168–74.
10. Murray LA, Sivaloganathan S. Rambutt – the killer sheep. *Med Sci Law* 1987;**27**:95–7.
11. Irandoust S, Heath K, Byard RW. Sheep shearing and sudden death. *J Forensic Leg Med* 2013;**20**:944–6.
12. De Giorgio F, Polacco M, Rossi R, Lodise M, Rainio J. Fatal blunt injuries possibly resulting from sexual abuse of a calf: a case report. *Med Sci Law* 2009;**49**:307–10.
13. Ozyürekoğlu T, Napolitano M, Kleinert JM. Hay baler injuries to the upper extremity. *J Trauma* 2007;**63**:62–9.
14. McKinnon DA, Robinson DW, Masters FW. Hay baler injuries. *J Trauma* 1967;**7**:265–74.